## ABSTRACT

| Enhanced Cable Modern Termination System (CMTS) functionality, including                 |
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| programmable digital domain modulators and demodulators for dynamic channel              |
| assignment, is incorporated into Fiber Nodes (FNs) or mini Fiber Nodes (mFNs),           |
| yielding enhanced Fiber Nodes (eFNs). These eFns distribute CMTS functionality deep      |
| into Hybrid-Fiber-Coax Networks (HFCN) rather than centralizing the CMTS functions       |
| within a single location. Moving the cable modem terminations closer to the subscribers  |
| shortens the analog RF paths required to support cable modems. Communication of both     |
| subscriber data and CMTS control data is performed over Ethernet-compatible packet       |
| networks between the field-based CMTSs and an upstream facility (e.g., the Head End),    |
| which includes an Internet gateway. Packet data for multiple subscriber cable modems is  |
| easily compressed and merged over common network paths, reducing cabling plant           |
| complexity and increasing bandwidth utilization. This approach dramatically reduces      |
| the infrastructure cost per cable modem. Distributing CMTS functionality among           |
| multiple eFNs also reduces demands on already stretched resources at the Head End for    |
| space, power, and HVAC. For HFCN channels containing signals with modulation or          |
| encoding schemes that are unknown or best processed upstream, the invention also         |
| provides for tunneling their spectrum over the same packet network as used for the cable |
| modem data. The channels to be tunneled are isolated using digital receivers, translated |
| to baseband, their data framed, merged with cable modem subscriber data, and             |
| transmitted over the packet network. Upstream, the framed channel data is parsed and     |
| the original channel spectrum reconstructed to permit information recovery.              |